Mantis®

Tiller/Cultivator

with Fast Start Engine Option

OWNER'S MANUAL

WELCOME TO THE WORLD OF MANTIS GARDENING!

Here's your new MANTIS Tiller... the lightweight wonder that "Makes Gardening Easier."

Unlike big tillers, your MANTIS Tiller weighs only 20 pounds. So it lifts easily, handles smoothly, tills and weeds precisely. And, unlike other small tillers, it features serpentine tines that churn soil up to ten inches deep. It creates a soft, smooth seed bed, even in problem soil.

Once you know how to use your tiller correctly, we guarantee you'll love it. So first, please read this manual. It shows, step by step, how to use your tiller safely. Plus, it shows how the MANTIS Border Edger can make light work of your edging needs.

If you have questions about any topic in this Manual, or for the name of your local dealer, call **1-800-366-6268** toll free, Monday - Saturday, 8:00 a.m. to 5:00 p.m., Eastern Time. Dealers can also be located online at **www.mantisdealer.com**.

Attention Mantis Product Owners! Get maintenance tips for your Mantis product on our web site at www.mantis.com Click on **ASK MANTIS**, then **TIPS FOR OWNERS.**

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SAFETY RULES & WARNINGS

You will notice throughout this Owners Manual **Safety Rules and Important Notes**. Make sure you understand and obey these warnings for your own protection.

I. Special Safety Information

⚠ WARNING • DANGER ⚠

ATTENTION: THIS SYMBOL POINTS OUT OUR IMPORTANT SAFETY INSTRUCTIONS.

WHEN YOU SEE THIS SYMBOL, ⚠ HEED IT'S WARNING!! STAY ALERT!!

⚠ WARNING • DANGER ⚠

TO REDUCE THE POTENTIAL FOR ACCIDENTS, COMPLY WITH THE SAFETY INSTRUCTIONS IN THIS MANUAL.

FAILURE TO COMPLY MAY RESULT IN SERIOUS PERSONAL INJURY, AND/OR EQUIPMENT AND PROPERTY DAMAGE.

II. Safety & Warnings

⚠ WARNING • DANGER ⚠

IMPROPER USE OR CARE OF THIS TILLER OR FAILURE TO WEAR PROPER PROTECTION CAN RESULT IN SERIOUS INJURY.

READ AND UNDERSTAND THE RULES FOR SAFE OPERATION AND ALL INSTRUCTIONS IN THIS MANUAL.

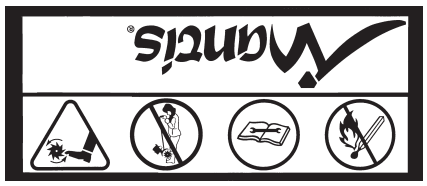
WEAR HEARING AND EYE PROTECTION.

⚠ WARNING

The Engine Exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

III. Safety Decal Information

An important part of the safety system incorporated in this tiller are the warning and information decals found on various parts of the tiller. These decals must be replaced in time due to abrasion, etc. It is your responsibility to replace these decals when they become hard to read. The location and part numbers (P/N) of these decals are illustrated on Page 16.



P/N 400620

P/N 400630

CUTTING HAZARD; KEEP FEET AND HANDS AWAY FROM ROTATING TINES.

DO NOT CARRY THE TILLER IN THIS POSITION.

READ OWNER'S MANUAL BEFORE USING TILLER, OR PERFORMING ANY REPAIR OR MAINTENANCE. KEEP OWNERS MANUAL IN A SAFE PLACE.

DON'T FUEL, REFUEL, OR CHECK FUEL WHILE SMOKING, OR NEAR AN OPEN FLAME OR OTHER IGNITION SOURCE.

DON'T OPERATE INDOORS

CAUTION: WHEN ASSEMBLING THE HANDLES, MAKE SURE FUEL TANK FACES OPERATOR. THIS IS THE REAR OF THE TILLER, REFER TO ASSEMBLY INSTRUCTION ON PAGE 7.

INCORRECT ASSEMBLY.

WEAR EAR AND EYE PROTECTION.

MIX UNLEADED GAS WITH 2 CYCLE 50:1 OIL.

EMISSION CONTROL

The emission control system for the engine is EM/TWC (Engine Modification and 3-way Catalyst) and for the fuel tank the Control System is EVAP (Evaporative Emissions) or N (for nylon tank). Evaporative emission may be applicable to California models only.

EMISSION CONTROL INFORMATION
ENGINE FAMILY:☐EHXS.0454KA DISPLACEMENT: 45.0cc
EMISSION COMPLIANCE PERIOD = 300 HOURS
THIS ENGINE MEETS U.S. EPA EXH/EVP REGS FOR MODEL YEAR ☐☐☐
REFER TO OWNER'S MANUAL FOR MAINTENANCE SPECIFICATIONS AND ADJUSTMENTS.
YAMABIKO CORP. ☐ ☐☐☐☐

An Emission Control Label is located on the engine (This is an EXAMPLE ONLY, information on label varies by engine FAMILY.)

PRODUCT EMISSION DURABILITY

The 300 hour emission durability compliance period is the time span selected by the manufacturer certifying the engine emissions output meets applicable emissions regulations, provided that approved maintenance procedures are followed as listed in the Maintenance Section of this manual.

⚠ WARNING • DANGER ⚠

IF THE TILLER IS USED IMPROPERLY OR SAFETY PRECAUTIONS ARE NOT FOLLOWED, THE USERS RISK SERIOUS INJURY TO THEMSELVES AND OTHERS. READ AND UNDERSTAND THIS MANUAL BEFORE ATTEMPTING TO OPERATE THIS TILLER.

⚠ WARNING • DANGER ⚠

OPERATION OF THIS EQUIPMENT MAY CREATE SPARKS THAT CAN START FIRES AROUND DRY VEGETATION. A SPARK ARRESTOR IS INSTALLED. THE OPERATOR SHOULD CONTACT LOCAL FIRE AGENCIES FOR LAWS OR REGULATIONS RELATING TO FIRE PREVENTION REQUIREMENTS.

IV. Warnings - Do's

Read and understand the owner's manual. Pay particular attention to all sections regarding safety.

1. Always keep a firm grip on both handles while the tines are moving and/or the engine is running. BE AWARE!! The tines may coast after throttle trigger is released. Make sure tines have come to a complete stop and engine is off before letting go of the tiller.

2. Always maintain a firm footing and good balance. Do not overreach while operating the tiller. Before you start to use the tiller check the work area for obstacles that might cause you to lose your footing, balance or control of the machine.

3. Thoroughly inspect the area where equipment is to be used and remove all objects, which can be thrown by the machine.

4. Always keep area clear of children, pets, and bystanders.

5. Always stay alert. Watch what you are doing and use common sense. Do not operate unit when fatigued.

6. Always dress properly. Do not wear loose clothing or jewelry, they might get caught in moving parts. Use sturdy gloves. Gloves reduce the transmission of vibration to your hands. Prolonged exposure to vibration can cause numbness and other ailments.

7. While working, always wear substantial footwear and long trousers. Do not operate the equipment when barefoot or wearing open sandals.

8. Always wear ear and eye protection. Eye protection must meet ANSI Z 87.1. To avoid hearing damage, we recommend hearing protection be worn whenever using the equipment.

9. To reduce fire hazard, keep the engine, and petrol/gas storage area free of vegetative material and excessive grease.

10. Start the engine carefully, according to the manufacturer's instructions and with feet well away from tool(s).

11. Keep all nuts, bolts and screws tight to be sure the equipment is in safe working condition.

12. Use extreme caution when reversing or pulling the machine towards you.

13. Work only in daylight or good artificial light.

14. Always be sure of your footing on slopes.

15. Exercise extreme caution when changing direction on slopes.

16. Always keep a safe distance between two or more people when working together.

17. Always inspect your unit before each use and ensure that all handles, guards and fasteners are secure, operating, and in place.

18. Always maintain and examine your Tiller with care. Follow maintenance instructions given in manual.

19. Always store tiller in a sheltered area (a dry place), not accessible to children. The tiller as well as fuel should not be stored in a house.

V. Warnings - Don'ts

Don't use tiller with one hand. Keep both hands on handles with fingers and thumbs encircling the handles, while tines are moving, and engine is running.

Don't overreach. Keep a good footing at all times.

Don't run with the machine, walk.

Don't work on excessively steep slopes.

Don't attempt to clear tines while they are moving. Never try to remove jammed material before switching the engine off and making sure the tines have stopped completely.

Don't allow children or incapable people to operate this tiller.

Don't operate while under the influence of alcohol or drugs.

Don't attempt to repair this tiller. Have repairs made by a qualified dealer or repairman. See that only original MANTIS parts are used.

⚠WARNING • DANGER⚠

HANDLE FUEL WITH CARE, IT IS HIGHLY FLAMMABLE. FUELING A HOT ENGINE OR NEAR AN IGNITION SOURCE CAN CAUSE A FIRE AND RESULT IN SERIOUS PERSONAL INJURY AND/OR PROPERTY DAMAGE.

VI. Engine/Fuel Warnings - Do's

Always use fresh gasoline in the fuel mixture. Stale gasoline can cause damage.

Always store fuel in containers specifically designed for this purpose.

Always pull starter cord slowly until resistance is felt. Then pull cord rapidly to avoid kickback and prevent arm or hand injury.

Always operate engine with spark arrestor installed and operating properly. The use of spark arrestor mufflers is required by law in the state of California (Section 4442 of the California Public Resources Code), as well as in other states or municipalities. Federal laws apply on federal lands.

Stop the engine whenever you leave the machine.

Allow the engine to cool before storing in any enclosure.

If the fuel tank needs to be drained, this should be done outdoors.

VII. Engine/Fuel Warnings - Don'ts

Don't fuel, refuel or check fuel while smoking, or near an open flame or other ignition source. Stop engine and be sure it is cool before refueling.

Don't leave the engine running while the tiller is unattended. Stop engine before putting the tiller down or while transporting from one place to another.

Don't refuel, start or run this tiller indoors or in an improperly ventilated area.

Don't run engine when electrical system causes spark outside the cylinder. During periodical checks of the spark plug, keep plug a safe distance from cylinder to avoid burning of evaporated fuel from cylinder.

Don't check for spark with spark plug or plug wire removed. Use an approved tester.

Don't crank engine with spark plug removed unless spark plug wire is disconnected. Sparks can ignite fumes.

Don't run engine when the odor of gasoline is present or other explosive conditions exist.

Don't operate the unit if gasoline is spilled. Clean up spill completely before starting engine.

Don't operate your tiller if there is an accumulation of debris around the muffler, and cooling fins.

Don't touch hot mufflers, cylinders or cooling fins as contact may cause serious burns.

Don't change the engine governor setting or over speed the engine.

ASSEMBLY

⚠ WARNING • DANGER ⚠

IMPROPER ASSEMBLY OF THIS TILLER CAN RESULT IN SERIOUS INJURY. MAKE SURE TO FOLLOW ALL INSTRUCTIONS CAREFULLY.

IF YOU HAVE ANY QUESTIONS CONTACT OUR FACTORY AT 1-800-366-6268 OR AN AUTHORIZED MANTIS DEALER

Your MANTIS Tiller comes partially assembled. You must install only the handlebars, the carrying handle, and the tines. This will take just a few minutes if you follow the directions.

First, take all items out of the carton. But do not remove the cardboard from around the Tiller's base.

The list at the right, shows the parts that come with your tiller. Check to make sure you have them.

The bag of hardware is in the plastic bag containing the Owner's Manual and DVD.

To assemble your MANTIS Tiller, you'll need two 7/16" wrenches or two adjustable wrenches. We suggest that you install all nuts and bolts only "finger tight" — that is, one-half to one full turn — until you've completed assembly. **The nuts are self locking, but you must use a wrench to tighten them completely.**

HOW TO ASSEMBLE LOWER HANDLES

To identify part numbers, see page 16.

1. Use the protective cardboard sleeve to stabilize your tiller. Stand the engine assembly (#T8) up.

2. Lay the handle parts within easy reach. You'll need one of the handle clamps (#T38) and one of the lower handles (#T3). Note that the lower handles have a short leg on one end. (Picture 1)

3. Fit the handle clamp along the outside of the short leg. Line up the holes on the clamp and the leg.

4. Choose one of the two 3-inch bolts (#T36). Slide it through the first set of holes — near the elbow where the lower handle curves. (Picture 2)

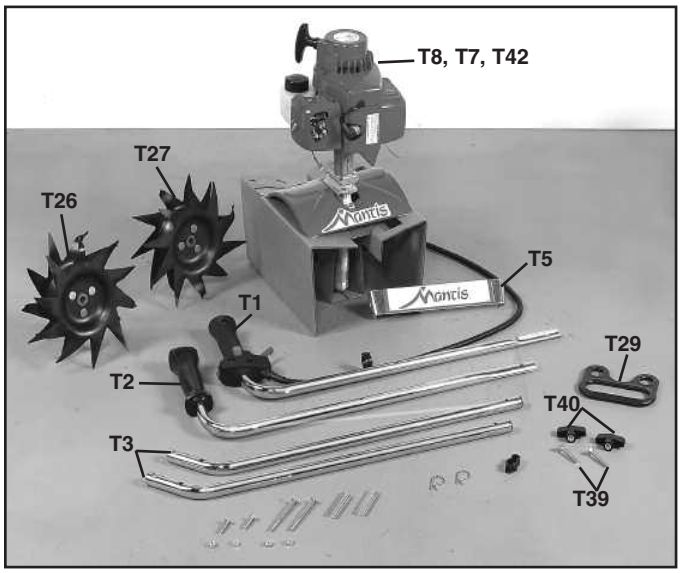
5. Now slide the other lower handle onto the 3-inch bolt. (Picture 3.) Fit the other clamp onto this other handle's short leg. Add a nut and tighten finger tight.

6. Locate the worm gear housing. It starts just above — and extends down through — the tiller's red fender guard. You'll notice that there's a recessed channel on either side of the housing's top. (Picture 4.)

7. Take the lower handles that you've just put together. Slide them into the two recessed channels.

⚠ Make sure you insert them from the rear of the tiller (gasoline tank faces the operator)... so that the bolt fits along the back of the housing. (Picture 5)

8. Slide the second 3-inch bolt through the second set of holes in the short legs. Add a nut and tighten finger tight.



Quantity	Description	*Key #
1	Upper Handle Assembly	T2
1	Upper Handle Throttle Side Assembly	T1
2	Lower Handles	T3
1	Pair Tiller/Cultivator Tines	T26/T27
1	Engine Assembly (includes Fender Guard & Worm Gear Transmission)	T8, T7, T42
1	Handle Brace	T5
1	Plastic Carrying Handle	T29
1	Bag of Hardware Containing:	
2	Cap Screws	T34*
4	Lock Nuts	T35
2	Bolts (3" long)	T36
2	Tine Retaining Pins	T28
2	Handle Clamps	T38
1	Throttle Clips	T6
2	Bolts	T39
2	Knobs	T40

*These numbers are the same numbers shown on the Parts Layout on page 16.

Picture 1

Picture 2

Picture 3

Picture 4

Picture 5

NOTE: THE LOCK NUTS ARE STAMPED. FINGER TIGHT IS APPROXIMATELY 1/2 TO 1-1/2 TURNS.

ASSEMBLY (continued)

HOW TO ASSEMBLE UPPER HANDLES & PLASTIC CARRYING HANDLE.

1. Lightly squeeze the lower handles (#T3) toward one another so that they line up with the two smaller holes on the carrying handle (#T29). Then slide the carrying handle over and down the lower handles. It will rest about four to six inches above the engine. (Picture 1)

2. Gently pull the lower handles out to their original position.

3. Attach the upper handle assembly (#T1) – the handle with the throttle cable and ground wire – onto the right handle, and secure with the handle knob (#T40) and 1 round head bolt (#T39) (Picture 2). **Be sure you have proper throttle movements and that the throttle cable is not wrapped or twisted around the handle bar.** Press lockout button, squeeze trigger and let go. The triangle must click in both directions. If there is any doubt, remove air filter and visually check that the throttle triangle hits both the idle screw and the full open stop. THIS MUST BE DONE BEFORE STARTING THE ENGINE.

4. Follow the same steps to install the left upper handle onto the other lower handle. (Picture 3)

5. Use the clip (#T6) to secure the throttle cable and wire in place on the lower handle. (Picture 4)

6. Now install the Handle Brace. Line it up with the holes on the upper handles. Then insert a Cap Screw (#T34) and a Lock Nut (#T35) on either side (Picture 5)

7. Use a wrench to tighten Cap Screws and Lock Nuts.

8. Now use wrench to tighten all nuts and bolts firmly and securely.

IMPORTANT NOTE:

Make sure you have installed the handles properly. When you stand behind your tiller, holding the handles, you should face the gasoline tank.

Picture 1

Picture 2

Picture 3

Picture 4

Picture 5

⚠ WARNING:
Improper throttle installation can cause tines to rotate unexpectedly.

Assembling the Tines for Tilling

1. Remove the cardboard from around your Tiller's base.

2. Slide the tines onto the axle shafts. The "D" hole goes on the outside.

3. Make sure you've installed the tines properly for tilling. Liken the tines to your fingers. When your palm faces the ground, your fingers curl down. Stand behind the Tiller and hold your hand next to the tines. Do the tine blades curl down, as your fingers do? If so, they are in the *tilling* position. (To switch to the cultivating position, see page 11.)

4. To secure each tine to the axle, insert a tine retaining pin.

IMPORTANT NOTE:

Before you use your MANTIS Tiller, read the Safety Rules & Warnings on pages 3-4.

⚠ WARNING • DANGER ⚠

REMOVE TINES BEFORE STARTING ENGINE AND MAKING ADJUSTMENTS.

Here's how to mix the oil with the gas:

1. Pour 1/2 of the gasoline into a safe container. Do not mix the fuel and oil in the engine fuel tank.

2. Add 2.6 ounces of two-cycle engine oil to the gasoline and mix. Then add the rest of the gasoline.

3. Screw the cap onto the gasoline can. Then swirl the can to blend the oil and gas.

4. Carefully pour the fuel mix into the tiller's fuel tank. After putting the fuel tank's cap back on, wipe up any spilled fuel from tank and gasoline can.

IMPORTANT:

Two stroke fuel separates and ages. Do not mix more than you will use in a month. **Using old fuel can cause difficult starting or engine damage.** Shake fuel container to thoroughly mix fuel before each use. Do not attempt to run your engine on gasoline only, use proper fuel mixture.

Need more pre-measured engine oil? You can order it directly from Mantis or your local authorized Mantis dealer. Just call toll free 1-800-366-6268 and ask for our Sales Dept.

Remember …

- Always mix two-cycle oil with gasoline before fueling your tiller. Never, ever run your tiller on gasoline alone. This will ruin your engine and void all warranties.
- Always use a clean gas can and always use unleaded gas.
- Never try to mix the oil and gasoline in the engine fuel tank.
- Always mix oil and gas in the proper proportions: 2.6 ounces of two-cycle engine oil to one gallon of unleaded gasoline.

IMPORTANT NOTE:

Do Not use old or stale oil/gasoline mixture. Always use the proper oil/gasoline mixture. If you do not, your engine will suffer rapid, permanent damage. *And* you will void the engine warranty.

ASSEMBLY *(continued)*

⚠ WARNING • DANGER

FUEL IS EXTREMELY FLAMMABLE. HANDLE IT WITH CARE. KEEP AWAY FROM IGNITION SOURCES. DO NOT SMOKE WHILE FUELING YOUR EQUIPMENT.

Mixing Fuel

Your MANTIS Tiller is powered by a commercial two stroke, air cooled engine which requires a fuel mixture of gasoline and lubricating oil.

Use a mixture of 50 parts unleaded regular gasoline and 1 part two-stroke MANTIS oil (50:1.) Use branded 89 octane (R+M+2) unleaded gasoline or gasohol (maximum 10% ethyl alcohol, or 15% MTBE, no methyl alcohol.)

⚠ WARNING • DANGER ⚠

ALTERNATIVE FUELS, SUCH AS E-20 (20% ETHANOL), E-85 (85% ETHANOL) OR ANY FUELS NOT MEETING ECHO REQUIREMENTS ARE NOT APPROVED FOR USE IN ECHO 2-STROKE GASOLINE ENGINES. USE OF ALTERNATIVE FUELS MAY CAUSE PERFORMANCE PROBLEMS, LOSS OF POWER, OVERHEATING, FUEL VAPOR LOCK, AND UNINTENDED MACHINE OPERATION, INCLUDING, BUT NOT LIMITED TO, IMPROPER CLUTCH ENGAGEMENT. ALTERNATIVE FUELS MAY ALSO CAUSE PREMATURE DETERIORATION OF FUEL LINES, GASKETS, CARBURETORS AND OTHER ENGINE COMPONENTS.

STARTING

To Start Your Tiller for the First Time:

1. Fill the fuel tank with the proper oil/gasoline mixture. (See previous section.)

2. Hand tighten the gasoline cap just until it's snug.

3. Place the **O/I** switch into the **I** "start/on" position. (Picture 1)

4. Pull the choke button all the way out, to completely close the choke. (Picture 2)

5. Locate the **purge bulb** on the upper right of the engine, in front of the fuel tank. **(See Picture 3)** It sends fuel into the carburetor, **for easy starting.** Press the **purge bulb** until you see fuel flow through the **clear fuel return line**. Since you're starting "cold," you may need to press six to eight times. As soon as fuel starts flowing through the clear fuel line, stop pressing! (Picture 3)

6. **Don't** press the throttle trigger during the starting of the engine.

7. NOTE: Energy is stored in the starter spring each time the handle/rope is pulled. Generally two to six pulls, using light pulling forces, will store enough energy to engage the starter and spin the engine. Do not pull the rope out to end stop.
NOTE: When the choke is closed, never pull the cord more than four or five times. Overpulling may cause flooding. Also, bear in mind that, when the engine **fires, it only coughs or sputters, and will not run on choke.**

8. Push the choke button in, all the way, to open the choke. (Picture 5)

9. Gently pull recoil starter handle/rope **(Piture 6)** until engine fires or 2 to 3 engine engagements.

10. Recoil Starter. Pull recoil starter rope until engine starts. NOTE: If engine does not start with choke in "Run" position after 5 engine engagements, repeat Cold Start instructions.Let the engine warm up two to three minutes before using.

Follow these steps whenever you are starting the engine "cold", or when the engine has run dry and you have just added fuel.

Picture 1

Picture 2

Picture 3

Picture 4

Picture 5

Picture 6

Never use starting fluids as they will cause permanent engine damage. Using them will void the warranty. Before you use the tiller, read the Safety & Warning rules on pages 3-4.

Starting a Warm Engine

1. Push ignition switch to **I** "start/on" position.

2. Push choke button in to the RUN (open) position.

3. If there is no fuel in the clear return line, push primer bulb 3-4 times or until fuel is visible in the line.

4. Pull starter rope using 2 to 6 short pulls.

5. If engine fails to start in 4 pulls, use "First Time" starting procedure on page this page.

6. With engine running, and both hands on the handles, press the throttle lock out button (Pic. 1), then squeeze the throttle trigger gradually to increase the engine speed and engage the tines.

NOTE: Once the throttle trigger is squeezed, you can release the lockout button (Pic. 2).

NOTE: Step #6 must be repeated each time your tiller trigger is released.

Picture 1

Picture 2

⚠ WARNING ⚠

AVOID ACCIDENTAL BLADE ENGAGEMENT

DO NOT SQUEEZE THE THROTTLE TRIGGER WHEN STARTING.

MAINTAIN PROPER IDLE SPEED ADJUSTMENT (2500-3100 RPM)

STARTING (continued)

Additional Information

How to Stop the Engine

Picture 3

Simply push the **O/I** "stop/start" switch to "**O**" (Picture 3). This will stop the engine instantly. If it should ever fail to do so, just pull out the choke button. The engine will stop at once.

About the Choke

The choke controls the amount of air drawn into the engine. Your tiller will run only if the choke is open — that is, if the choke is pushed in.

A Special Feature (with the idle set properly and the engine running)

Even when the engine is running, the tines won't turn unless you press the throttle lock out button and squeeze the throttle lever on the handlebars. And, when you release the throttle lever, the tines will stop.

A Tip for Extending Your Engine's Life

After you start the engine, let your tiller warm up for two to three minutes before you use it. Then, before you put your tiller away, let it idle for a minute to give the engine a chance to cool down.

WARNING • DANGER

IF ENGINE DOES NOT STOP WHEN SWITCH IS PUT IN THE STOP POSITION, RELEASE THE THROTTLE, ALLOW ENGINE TO IDLE. PUT THE TILLER DOWN, AND PULL THE CHOKE BUTTON OUT TO COLD START (CLOSED) POSITION. CHECK AND RETURN IGNITION SWITCH TO ON POSITION BEFORE STARTING ENGINE AGAIN.

WHAT TO DO JUST IN CASE

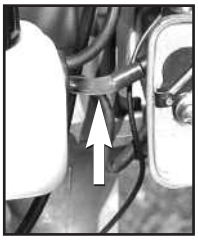
If you follow the normal starting procedure, you should have no problem starting your tiller. But, just in case you do have problems, here's what to do.

Make sure the **O/I** switch is on **I** "start." You'd be surprised how many people forget to push the switch into the "**I**" position.

If the switch was on "**O**" when you pulled the cord, you may have flooded the engine.

Picture 1

Picture 2


Picture 3

⚠WARNING⚠

MAKE SURE THE START/STOP SWITCH IS IN THE STOP POSITION. KEEP PLUG WIRE AWAY FROM ENGINE TO AVOID UNINTENTIONAL SPARK.

- First, examine the spark plug. Use the special wrench that comes with our **optional** MANTIS Handy Item Kit (Item #8444) or a 3/4 inch spark plug wrench. (Picture 1)
- Remove the cap over the spark plug.
- Unscrew the spark plug. (Picture 2)

IMPORTANT NOTE:

To avoid possible damage to the threads, do not try to remove the plug from a hot aluminum cylinder head.

Starting a Flooded Engine

1. If the end of the spark plug is wet, the engine may be flooded. **Make sure the switch is in the "O" position, disconnect spark plug wire and remove plug. Use a paper towel or a clean rag to dry the spark plug, then, with the spark plug out of the engine, pull the starter cord several times.** Next, replace the spark plug. Use the wrench to tighten it and replace the cap. Next, put the switch in the "**I**" position and pull the choke button out. Pull the starter cord three or four times until the engine coughs or sputters. Open the choke (push the choke button in) and pull the cord a few times. The engine should start and run.

2. If the end of the spark plug is dry, check to see if the fuel line is blocked. First loosen the fuel cap to relieve the pressure in the tank. The fuel line runs from the fuel tank to the carburetor. Pull it off at the carburetor end. Fuel should drip slowly from the line. Wipe off any excess or spilled fuel.

If fuel does not drip from the line, check the line for any bends or pinches. (Picture 3). Kinks in the line restrict the flow of fuel to the engine. Just straighten out the line. Reconnect. Then follow the normal starting procedure.

If fuel drips too freely, the line may be disconnected from the fuel filter. You'll find the fuel filter inside the fuel tank. Just re-attach the line to the filter, and put the filter back in the tank. Then follow the normal starting procedure.

Here's Another Way to Start your MANTIS Tiller

If you follow the steps above and your engine still won't start, try this:

1. Push the switch to "**I**".

2. Push in the choke button to open the choke.

3. Press the plastic bubble a few times.

4. Give the starter cord a few short, quick pulls. The engine should start and run.

5. If the engine does not start, then pull out the choke button to close the choke. Pull the starter cord four to five times. The engine should sputter or cough.

6. After the engine sputters, push the choke button in. Then pull the starter cord. The engine should start and run.

7. If the engine still does not start, repeat steps 2 through 6.

8. If the engine still does not start, call 1-800-366-6268 and ask for Customer Service or the name of your local MANTIS dealer.

IMPORTANT NOTE:

Never use starting fluids. Starting fluids will cause permanent engine damage. Using them will void the warranty.

IMPORTANT NOTE:

Before you use your MANTIS Tiller, read the Safety Rules & Warnings on pages 3-4.

GETTING YOUR TILLER TO YOUR GARDEN

Walk it.

Once your tiller is running, you can "walk" it to your garden. Just press the throttle lock out button and squeeze the throttle lever gently and let the tiller "tip-toe" across your yard on its tines. It won't hurt your lawn or driveway.

Carry It.

Make sure the engine is off. Then use one hand to grasp the convenient carrying handle. Use the other hand to hold the handlebars. (Picture 1) Then lift your tiller and carry it to your garden. Since it weighs only 20 pounds, it won't strain your muscles or tire you out!

Take It for a Ride.

You can easily transport your MANTIS Tiller to a friend's or relative's house. Just empty the fuel tank. (**This is crucial.**) Then stow your Tiller in the trunk of your car or truck. It fits easily. And you can put it in and take it out without straining your back.

Picture 1

Picture 2

⚠WARNING⚠

NEVER CARRY YOUR TILLER AS THE PERSON IN PICTURE 2 IS DOING. IF YOU DO, YOU WILL SUFFER SERIOUS INJURY.

TILLING

Picture 1

Picture 2

Picture 3

Now You're Ready to Use Your MANTIS Tiller.

If you've seen other tillers, your MANTIS Tiller may surprise you. It tills best when you pull it backward! You see, when you pull your MANTIS Tiller backward, you give extra resistance to the tines, so they dig deeper. (Picture 1)

What's more when you go backward, you erase your footprints. So your soil stays light and fluffy. With other tillers, by contrast, you walk right over the soil you've just tilled, packing it down, so it's less plantable.

Run Your MANTIS Tiller like a Vacuum Cleaner.

Place your Tiller at the head of the row or area you want to till. Start it up. Then use an easy rocking motion. First, pull your Tiller backward. Then use an easy rocking motion. Again, pull your Tiller backward. Then, let it move forward just a little bit. Then pull it backward again. This will help you till deeper.

Keep repeating these steps until you've tilled an entire row. Start again on the next row. It's much like running a vacuum cleaner! (Picture 2)

You Can Even Control Depth.

For Deeper Tilling:

Move your Tiller slowly back and forth, as you would a vacuum cleaner. Work the same area over and over until you've dug to your desired depth. (Picture 3)

For Shallow Tilling:

Switch the tines to the cultivating position. (See page 11 to learn how.) Then move your Tiller quickly over your soil surface.

For Big Weeds or Tough Roots:

Let your Tiller rock back and forth over the tough spot, until the tines slice through the weed or root.

Your MANTIS Tiller Handles Special Tilling Projects.

Want to turn part of your lawn into a colorful flower border? Your MANTIS Tiller makes it easy! Just run your Tiller back and forth until the sod begins to break up. Then continue tilling. Your Tiller will chop the clumps of sod until they're fine. Then, it will work them into the soil. Pretty soon, you'll have a soft, fresh planting bed.

⚠WARNING • DANGER⚠

THE OPERATOR OF THIS TILLER IS RESPONSIBLE FOR ACCIDENTS OR HAZARDS OCCURRING TO HIMSELF, OTHER PEOPLE OR THEIR PROPERTY.

ENGINE SPECIFICATIONS

Dry Weight . . . . . .2.8kg — 6 lbs., 3 ounces
Type of Engine . . . .Air Cooled, Two stroke, Single-Cylinder, Gasoline Engine
Rotation . . . . . .Clockwise, viewed from TOP
Bore . . . . . .32.2 mm (1.268 in.)
Stroke . . . . . .26.0 mm (1.04 in.)
Spark Plug . . . . . .NGK BPM8Y
Fuel . . . . . .Premixed two stroke fuel
Fuel Oil Ratio . . . . .50:1 ratio with MANTIS oil
Gasoline . . . . . .Unleaded (see page 7)

Displacement . . . . .21.2 cc (1.294 cu. in.)
Exhaust System . . . .Spark arrester muffler
Carburetor . . . . . .ZAMA diaphragm model C1U type
Ignition System . . . .Flywheel magneto, capacitor discharge ignition type
Starter . . . . . .Automatic rewind with power spring assist
Oil . . . . . .Designated, two-stroke, air-cooled engine oil
Fuel Tank Capacity .0.5 lit. (17.0 oz.)

SERVICE MAINTENANCE GUIDE

COMPONENT/ SYSTEM	MAINTENANCE PROCEDURE	REQ'D SKILL LEVEL	DAILY OR BEFORE USE	EVERY REFUEL	3 MONTHS OR 90 HOURS	YEARLY 600 HOURS
Air Filter	Inspect/Clean	1	I/C*			
Choke Shutter	Inspect/Clean	1	I/C			
Fuel Filter	Inspect	1			I*	I/R*
Fuel Cap Gasket	Inspect/Replace	1			I*	
Fuel System	Inspect/Replace	1	I(2)*	I(2)*		
Spark Plug	Inspect/Clean	1			I/C/R*	
Cooling System	Inspect/Clean	2	I/C			
Muffler Spark Arrestor	Inspect/Clean/Replace	2			I/C/R*	
Cylinder Exhaust Port	Inspect/Clean/Decarbon	2			I/C	
Gear Housing	Grease	2			I(1)	
Tines	Inspect/Clean	1	I/C			
Recoil Starter Rope	Inspect/Clean	1	I/C*			
Screws/Nuts/Bolts	Inspect/Tighten/Replace	1	I*			

MAINTENANCE PROCEDURE LETTER CODES: **I = INSPECT, R = REPLACE, C = CLEAN**
IMPORTANT NOTE - Time intervals shown are maximum. Actual use and your experience will determine the frequency of required maintenance.
MAINTENANCE PROCEDURE NOTES:
(1) Apply "0" or "00" EP Grease every 25 hours of use.
(2) Low evaporative fuel tanks DO NOT require regular maintenance to maintain emission integrity.
* Replacement is recommended based on the finding of damage or wear during inspection.

Notes:

TILLING/CULTIVATING

⚠ WARNING • DANGER ⚠

IF YOUR TINES GET JAMMED OR ENTANGLED, SHUT OFF THE ENGINE AT ONCE. REMOVE THE SPARK PLUG WIRE THEN REMOVE THE OBSTRUCTION WHILE THE ENGINE IS OFF. NEVER TRY TO REMOVE AN OBSTRUCTION WHILE THE ENGINE IS RUNNING. SERIOUS INJURY CAN RESULT.

How about a family-size vegetable garden?

Nowadays many gardeners prefer small gardens — especially in the suburbs, where space is at a premium. But, if you're fortunate enough to own a large lot, you can create a bigger garden — a half acre or more. Here's how:

1. First, hire someone with a tractor or big tiller to break ground for you. This is a one-time-only investment that's well worth the small cost.

2. Then, use your Tiller to break up any remaining clumps of soil or sod. Unlike a tractor or big tiller, your MANTIS Tiller is a precision tool. It will pulverize your soil into a smooth seed bed.

Your MANTIS Tiller Makes Weeding a Pleasure!

As a tiller, your MANTIS Tiller works the soil down to 10" (25.4 cm) deep. But, as a cultivator, it gently cultivates the surface, only 2" to 3" (5.09 cm to 7.62 cm) deep.

First, you must change the tines to the weeding position. This takes less than a minute.

Then, your MANTIS Tiller's sharp "tine teeth" will slice up those pesky weeds, burying them as you go along. And, since the tines in this position won't dig too deep, they won't hurt your plants' precious root systems.

The result? Your Tiller will cut your weeding time in half, and turn a tiresome chore into a pleasure.

How to Switch From Tilling to Cultivating Position

1. Make sure your Tiller is off.

2. Remove the retaining pins from the tines.

3. Remove the tines from the axle.

4. Place the right-side tine onto the left-side axle. Place the left side tine onto the right-side axle. The "D" hole should be to the outside.

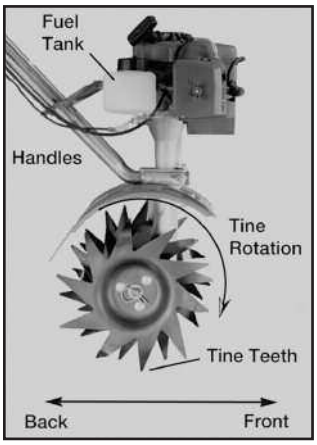
5. Here is how to make sure you've installed the tines properly. Stand behind the Tiller and hold your hand, palm up, next to the tines. Do the tine points curl up, as your fingers do? If so, they are in the correct cultivating position.

6. Reinsert the pins.

Picture 1

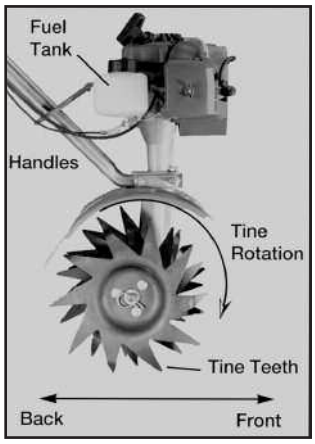
Picture 2

CULTIVATING



Tilling Position

Tine teeth point in the same direction as the rotation of the tine; or toward the front of the Tiller, away from the operator.



Cultivating Position

Tine teeth point in the opposite direction as the rotation of the tine. Tines point toward the back of the tiller, or toward the operator.

Now You're Ready to Cultivate or Weed.

Guide your Tiller where you want to weed and start it up. Pull your Tiller backward slowly, then let it move forward a bit, in a gentle rocking motion. Watch it slice, shred, and bury those weeds!

Got tough weeds? Lighten your pressure on the throttle to slow your Tiller down. Then work back and forth until your Tiller chops up the weeds. It's easy and effective!

Remember, any tiller will tangle in tall grass, stringy vines, or super-big weeds. So, if you have a "backyard jungle," first use a knife, pruner, or brush cutter to chop up the overgrowth. If the tines become tangled anyway, **push the switch to the "O" position to turn the engine off completely** before trying to clear them.

The optional Tine Detangler (Item #1322) will clear tines in a jiffy. Call 1-800-366-6268 for details. (Ask for the Sales Department.)

Your MANTIS Tiller Will Weed Between Narrow Rows!

Your MANTIS Tiller is a precision weeder that easily fits in tight places. So don't be afraid to weed anywhere: between plants and shrubs; in corners; against fences; on raised beds; in wide rows; even in very narrow rows. Your MANTIS Tiller weeds six* to nine inches wide. So you can run it in a tightly planted garden without damaging your delicate plants. That's good news for suburban gardeners, who often have to plant rows close together!

*With optional Planter Furrower attachment (Item #6222.)

MAINTENANCE

Check the Air Filter Often

A wet or dirty air filter can affect the way your engine starts, performs, and wears. So, it's a good idea to check your air filter once a month.

If you work in dusty soil, or if you want to be on the safe side — then check your filter more often (for instance, before each use). But be sure to replace it at least once a year, in the spring or fall. Clean or change it as needed. It is recommended to change the air filter yearly.

How to Check, Clean and Change the Air Filter

1. Loosen the wing nut on the side of the air-cleaner cover. (See Picture 1, or look up Key #1 in Intake Parts Assembly on page 17.)

2. Take off the cover. Make sure to clear the choke button. (Picture 2)

3. The air filter is the pad on the inside of the air-cleaner cover. Check whether it is soiled or moist.

4. If the air filter needs cleaning or no longer fits properly, remove it. Just lift an edge carefully and "peel" it out. (Picture 3)

5. Use a brush to remove debris from the pad.

6. If the air filter is so dirty that it won't come clean, you must replace it or severe engine damage will occur. Order a new one directly from our Customer Service Dept. Call 1-800-366-6268.

7. Insert your clean filter inside the air-cleaner cover.

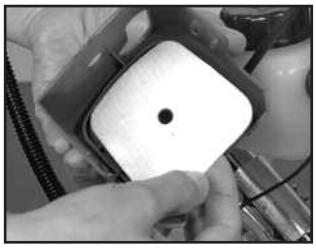
IMPORTANT! Make sure filter is "seated" properly in the cover. The filter must fit snugly inside the rim that holds the filter in place.

Installing the filter incorrectly will cause engine damage and void the warranty. Fit the cover back over the air cleaner. (Again, make sure to clear the choke button.)

8. Tighten the wing nut to secure the cover.

Picture 1

Picture 2



Picture 3

Note:

Please check the lip on the Air Cleaner Cover. If the lip is chipped or cracked, it should be replaced. This will prevent dirt from being ingested through the carburetor into the inside of the engine.

How to Check the Grease Level Inside the Worm Gear Housing

When we built your MANTIS Tiller, we lubricated the worm gear housing thoroughly.

It is imperative that you inspect the grease level once a year. Simply remove the cover plate on the worm gear housing. (Picture 1) Then check to make sure the grease comes almost to the top of the housing. If it doesn't, add lithium #0 grease (Item 9985.) This is the only way to add grease to the worm gear housing. (Picture 2) To purchase MANTIS grease, call our Sales Dept. at 1-800-366-6268.

Please do not overfill. Too much grease can create pressure, which could cause seals to fail or the clutch to slip.

Fuel Filter Replacement:

Fuel filter to be changed at the end of every season.

Clear Blockages From the Fuel Line & Filter:

Clear any blockages you see in the tank, fuel filter, or fuel line. Remember: The fuel filter is located inside the tank. (See Picture 3) Then use the normal starting procedure to start your Tiller.

We recommend fuel filter replacement each year.

Picture 1

Picture 2

Picture 3

MAINTENANCE *(continued)*

⚠ WARNING•DANGER ⚠
REMOVE TINES BEFORE STARTING ENGINE AND MAKING ADJUSTMENTS

What to Do if Your Engine Idles Too High

What if your engine runs too fast … or if the tines turn the instant you start the Tiller? You may need to adjust the idle screw (Key #A19 under Carburetor on page 17) by itself right below the H and L screws. Gently turn it counter-clockwise. You'll know you've adjusted it correctly when the axles do not turn at low idle.

What to Do if Your Engine Runs "Rough"

If your engine runs "rough" or stalls, you may need to adjust the carburetor and idle screws.

Picture 1

If you remove the air-cleaner cover, you'll see the two carburetor, adjustment screws next to the choke button. (Picture 1)

The "RED" screw is the HIGH-speed adjustment…The "WHITE" screw is the low speed adjustment.

First, remove the tines from the axle. Then start engine. Let it run for two to three minutes. "FLASH" the choke several times during the warm-up to clear any air from the Fuel system.

Then stop the engine after it reaches operating temperature.

Now, turn the RED, high-speed screw counter-clockwise all the way to stop…Then turn the WHITE, low speed screw halfway between the counter-clockwise and clockwise stop positions.

Now restart the engine to finish the carburetor adjustment.

Run the engine at full speed two or three seconds to clear out any excess fuel. Then return to idle.

Now, accelerate the engine to full throttle several times to check for a smooth transition from idle to high speed.

If the engine hesitates turn the WHITE, low-speed screw counter-clockwise one-eighth of a turn. Then accelerate the engine.

Repeat the adjustment until you get a smooth transition to high speed.

Picture 1 … Note how the engine doesn't sit all the way down on the transmission.

Picture 2 … Note how the engine sits all the way down on the transmission.

How to Reseat the Flange

At some point, you may find that the tines won't turn when you press the throttle. This may mean the engine isn't sitting all the way down on the worm gear housing.

Perhaps you've been using your Tiller for several years. Or perhaps you've removed the engine for use with our hedge trimmer attachment, then replaced it. In either case, the flange bolt (Key #D17, page 18) may have come loose and lifted the engine up.

If this happened you'll notice a gap between the bottom of the engine clutch case (Key #D19, page 18) and the top of the worm gear housing. (Picture 1)

To fix this, loosen the flange bolt. Take the engine off the worm gear housing. Notice the hex head on top of the drive shaft (Key #9, Page 16). Inside the clutch case, you'll find the clutch drum (Key #D23, Page 18). Make sure the hex head lines up with the clutch drum inside the clutch case.

Then put the engine back on the worm gear housing. Make sure the plastic carrying handle is not under the fuel tank.

If you've followed these steps properly, there will be no gap between the clutch case and the worm gear housing. (Picture 2) Make sure you tighten the flange bolt!

High Altitude Operation

This engine has been factory adjusted to maintain satisfactory starting, emission, and durability performance up to 1,100 feet (96,0 kPa and above) mean sea level (MSL). To maintain proper engine operation above 1,100 feet (96,0 kPa and above) MSL the carburetor may need to be adjusted by an authorized ECHO service dealer.

IMPORTANT
If the engine is adjusted for operation above 1,100 feet MSL, the carburetor must be re-adjusted when operating the engine below 1,100 feet MSL, otherwise severe engine damage can result.

Exhaust Port/Muffler Cleaning

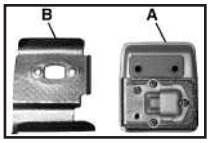
Tools required: 4mm Hex wrench, Wood or plastic scraper

Parts Required: As needed: Heat Shield

1. Remove spark plug lead from spark plug, and remove engine cover (2 screws).
2. Place piston at top dead center. Remove muffler (A) and heat shield (B).
3. Use a wood or plastic scraping tool to clean deposits from cylinder exhaust port.

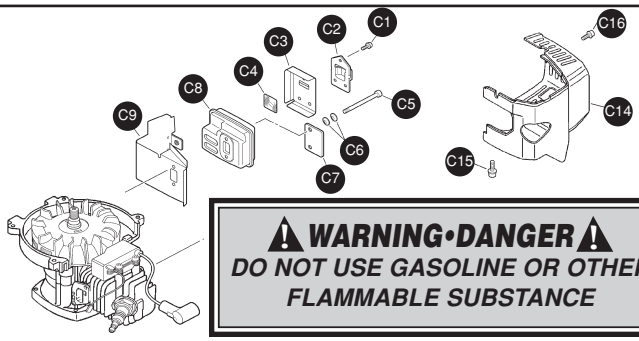
IMPORTANT
Never use a metal tool to scrape carbon from the exhaust port. Do not scratch the cylinder or piston when cleaning the exhaust port. Do not allow carbon particles to enter the cylinder.

4. Inspect heat shield, and replace if damaged.
5. Install heat shield and muffler.
6. Tighten muffler mounting bolts (or nuts) to 80-95 in•lbf (90-110 kgf•cm).
7. Start engine, and warm to operating temperature.
8. Stop engine, and re-tighten mounting bolts (or nuts) to specifications.
9. Install engine cover and attach spark plug lead.



Cleaning the Muffler Screen

1. Take out the spark plug.
2. Remove the red cylinder cover, (Key #D14) which is held on by 2 phillips-head screws, (Key #C15) and 1 hex-head screw, (Key #C16) which you will need an allen wrench to remove.
3. You will see the metal exhaust guide, held on by 3 more phillips-head screws. (Key #C1) Remove the exhaust guide.
4. Behind the exhaust guide (Key #C2) will be the muffler gasket (Key #C3) and muffler screen (Key #C4). The screen sits under the gasket.
5. If the screen (Key #C4) is clogged with deposits, it needs to be cleaned. Use carburetor cleaner, and any brush that is not metal. Brush the screen until you are able to see through it.
6. If the screen remains plugged after attempts at cleaning, it must be replaced.



⚠ WARNING•DANGER ⚠
DO NOT USE GASOLINE OR OTHER FLAMMABLE SUBSTANCE

STORAGE

Each fall — or before you store your MANTIS Tiller for any long period — be sure to take these measures:

1. Do not store your Tiller with fuel still in it. Even under ideal conditions, stored fuel containing ethanol or MTBE can start to go stale in 30 days. And, since stale fuel has a high gum content, it can clog the carburetor, this, in turn, will restrict fuel flow. **So, when you're ready to store your Tiller, or will not be using it for more than 2 weeks,** drain the fuel tank completely. (Picture 2)

2. Next, restart the engine to make sure no fuel is left in the carburetor. Then run the engine until it stops. This will prevent gum deposits, forming inside of the carburetor and possible engine damage.

3. Disconnect spark plug wire and remove the spark plug. (Use the wrench that comes in our **optional** Handy item Kit, Item #8444. Or use a 19mm or 3/4" spark-plug wrench.) Pour about a teaspoon of clean, air-cooled, two-cycle oil through the spark-plug hole into the combustion chamber. (Picture 3) Leaving the spark plug out slowly pull the starter cord two or three times to coat the inside of the cylinder wall.

4. Replace the spark plug with a NGK-BPM8Y. A replacement spark plug is included in the **optional** Handy Item Kit item # 8444.

5. Install the spark plug, but leave the spark plug wire disconnected.

6. Clean the air filter as described on Page 12.

7. Clean dirt, grass, and other materials from the entire machine.

8. Wipe the tines with oil or spray them with WD-40, to prevent rusting.

9. Oil the throttle cable and all visible moving parts. (Do not remove the engine cover.)

10. Replace the fuel filter.

11. Check the grease level in the worm gear housing, as described on page 12.

12. Order new parts to replace any that are badly worn or broken. Just call 1-800-366-6268 and ask for a local authorized Mantis dealer.

13. Store your Tiller, in an upright position, in a clean, dry place. You can store with the handles in an extended position or folded down. (Picture 1)

14. To fold the handles, follow these easy steps: Loosen the handle knobs (#40), fold the handles forward (see picture 1, inset). Tighten knob securely. Your handles are now folded and ready to store in a smaller area.

15. Do you have fuel left over from last season? Dispose of it properly. Buy fresh oil and gasoline next season.

How to Prepare Your MANTIS Tiller for Restarting

Unfold the handles into an upright or extended position. Tighten the two handle knobs (#40)

In the Spring, when you take your Tiller out of storage, remove the spark plug. Pull the starter cord three or four times to clean oil from the combustion chamber.

(Picture 4) Wipe oil from the spark plug. Place the spark plug back into the cylinder. Re-connect the spark plug wire back on the spark plug. Then follow the steps on pages 7 & 8 to refuel and restart your Tiller.

Again, Check the Carburetor.

If your Tiller won't restart in the Spring — or if it lacks its usual power — the carburetor may need attention. Follow the steps on page 13 for adjusting the H and L screws. (Picture 5)

Check the Spark Plug Too.

If your Tiller won't restart, or if it lacks full power, the spark plug may be at fault. Check to see if the plug is fouled with oily black deposits. Clean or replace it if it is. (Picture 6)

Also, check whether the center electrode is rounded at the end, or if the ground electrode is worn. If either is the case, you should replace it with a NGK-BPM8Y spark plug. Use a 19mm or a 3/4" spark-plug wrench to install it. Adjust the plug gap to .024 - .028 in. (0.6 to 0.7 mm)

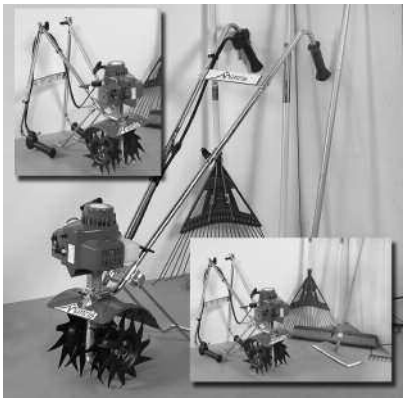
Caution: Do not over tighten the plug. The correct torque is 11 to 13 ft.-lbs. (15-17 N.m) or 130-150 in lbs and 150-170 kgl.

IMPORTANT NOTE:

To avoid possible damage to the threads, do not try to remove the plug from a hot aluminum cylinder head.

⚠ WARNING•DANGER ⚠

DO NOT STORE IN AN AREA WHERE FUEL FUMES MAY ACCUMULATE AND REACH A FLAME OR SPARK.



Picture 1

Picture 2

Picture 3

Picture 4

Picture 5

Picture 6

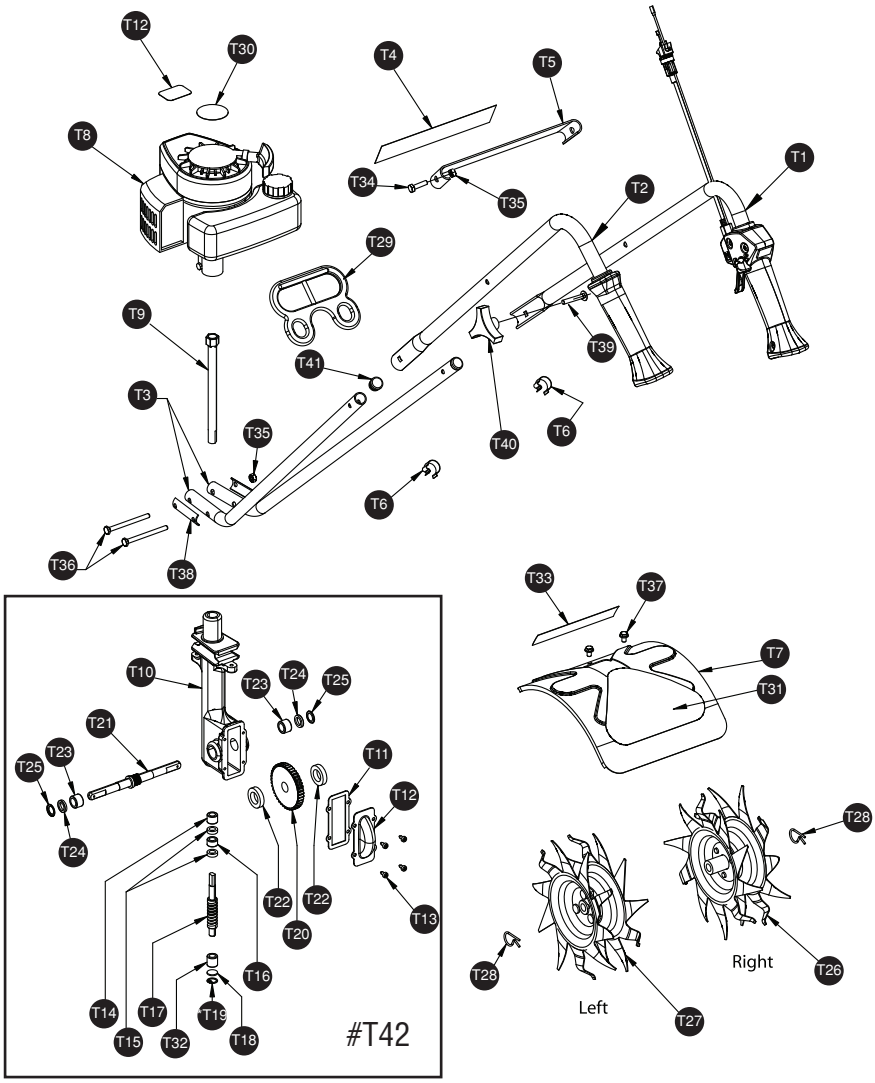
⚠ WARNING ⚠

Always make sure the handle knobs are secure before starting your MANTIS Tiller.

TROUBLE SHOOTING

Problem	Cause	Remedy
1. Tines don't turn when throttle is depressed	• Engine is not seated properly on the gear housing.	• Re-install engine following the instructions on page 13 (How to reseat the flange).
2. Engine fails to start	• **O/I** switch is in "**O**" position. • No fuel in tank. • Fuel strainer clogged. • Fuel line clogged. • Spark plug shorted or fouled. • Spark plug is broken (cracked porcelain or electrodes broken) • Ignition lead wire shorted, broken or disconnected from spark plug. • Ignition inoperative	• Move switch to "**I**." • Fill Tank. • Replace Strainer. • Clean fuel line. • Install new spark plug. • Replace spark plug. • Replace lead wire or attach to spark plug. • Contact your local authorized dealer.
3. Engine hard to start.	• Water in gasoline or stale fuel mixture. • Too much oil in fuel mixture. • Engine under or over choked. • Carburetor out of adjustment. • Gasket leaks (carburetor or cylinder base gasket). • Weak spark at spark plug.	• Drain entire system and refill with fresh fuel. • Drain and refill with correct mixture. • If flooded by over choking, proceed according to instructions in operation section. If under choked, move choke lever to closed position and crank two or three times. • See "Carburetor Adjustment." • Replace gaskets. • Contact your local authorized dealer.
4. Engine continuously floods.	• Fuel tank vent line is not in an upright position.	• Return the fuel tank vent line to the upright position and place it under the cylinder cover in the small "pocket" in the cylinder cover
5. There is black smoke coming from exhaust	• The muffler screen is clogged	• Clean carbon from muffler screen (page 13)
6. Engine misses.	• Dirt in fuel line or carburetor. • Carburetor improperly adjusted. • Spark plug fouled, broken or incorrect gap setting. • Weak or intermittent spark at spark plug.	• Remove and clean. • See "Carburetor Adjustment." • Clean or replace spark plug - set gap to .024-.028 in. (0.6-0.7 mm) • Contact your local authorized dealer.
7. Engine lacks power.	• Air filter clogged. • Carburetor out of adjustment. • Muffler clogged. • Clogged exhaust ports. • Spark Arrestor Clogged. • Poor compression.	• Clean or replace air filter. • See "Carburetor Adjustment". • Clean carbon from muffler. • Remove muffler, rotate engine until the piston is at top of cylinder. With a wooden scraper or blunt tool, remove all carbon from exhaust ports. Be careful not to scratch or damage piston or cylinder walls. Blow out all loose carbon with compressed air. Install muffler and gasket. • Clean Spark Arrestor • Contact your local authorized dealer.
8. Engine overheats.	• Insufficient oil in fuel mixture • Air flow obstructed	• Mix fuel as described in starting instructions. • Clean flywheel cylinder fins and screen.
9. Engine noisy or knocking.	• Spark plug in incorrect heat range. • Bearings, piston ring or cylinder walls are worn.	• Replace with plugs specified for engine. • Contact your local authorized dealer.
10. Engine stalls under load.	• Carburetor adjustment too "lean." • Engine overheats.	• See "Carburetor Adjustment." (page 13) • Remove dust and dirt from between fins.

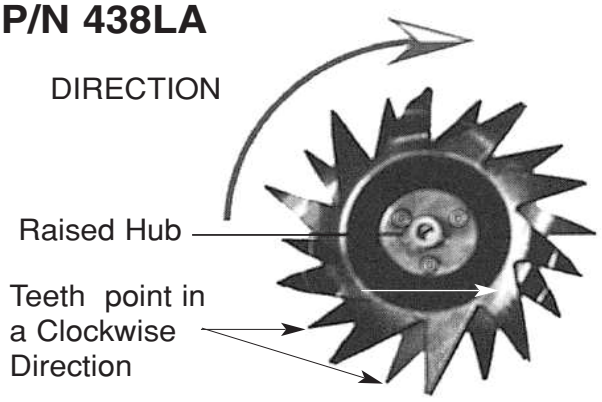
MANTIS TILLER ASSEMBLY



ITEM	PART #	QTY.	DESCRIPTION / REMARKS
T1	400261	1	Trigger Handle Assm. RH
T2	400263	1	Handle Assm. LH
T3	400224	2	Lower Handle - Fold Down
T4	400620	1	Label
T5	148	1	Handle Brace
T6	478	2	Throttle Clip
T7	465	1	Fender Guard
T8	400904	1	Engine Assm. SV-5CI/2
* T9	468	1	Drive Shaft
T10	466	1	Worm Gear Housing
T11	436	1	Gasket
T12	437A	1	Housing Cover
T13	651	4	Rd. Hd. Self Tapping Screw
T14	423	1	Roller Bearing
T15	425	2	Worm Bearing Race
T16	424	1	Worm Thrust Bearing
T17	422	1	Worm Shaft
T18	426	1	Worm Disk
T19	428	1	Retaining Ring
T20	429	1	Worm Gear
T21	431	1	Tine Shaft
T22	430	2	Worm Gear Thrust Washer
T23	432	2	Worm Gear Bearing
T24	434	2	Bearing Seal
T25	435	2	Bearing Seal Retainer
T26	438RA	1	Tine Assm. (RT)
T27	438LA	1	Tine Assm. (LT)
T28	418-1	2	Tine Retaining Hair Pin
T29	400133	1	Carrying Handle
T30	487MA	1	Engine Label
T31	4043	1	Tine Label
T32	458	1	Roller Bearing
T33	4058	1	Mantis Label
T34	410	2	Cap Screw 1/4-20 x 1" LG.
T35	972	4	Lock Nut 1/4 - 20
T36	470	2	1/4 - 20 x 3" Bolt
T37	140	2	Bolt 1/4-20 x 3/8" Lg.
T38	377	2	Handle Clamp
T39	400509	2	Bolt
T40	400523	2	Knob
T41	400230	2	Plug
T42	400010	1	Transmission Assm.

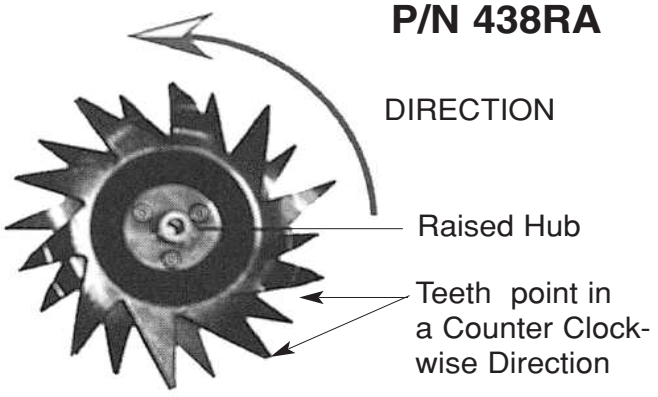
* Also in Key #T42

P/N 438LA



When you look at a Tine with the raised hub facing you and the teeth are pointing in a ***CLOCKWISE*** rotation, you have a ***LEFT HAND TINE***.

P/N 438RA

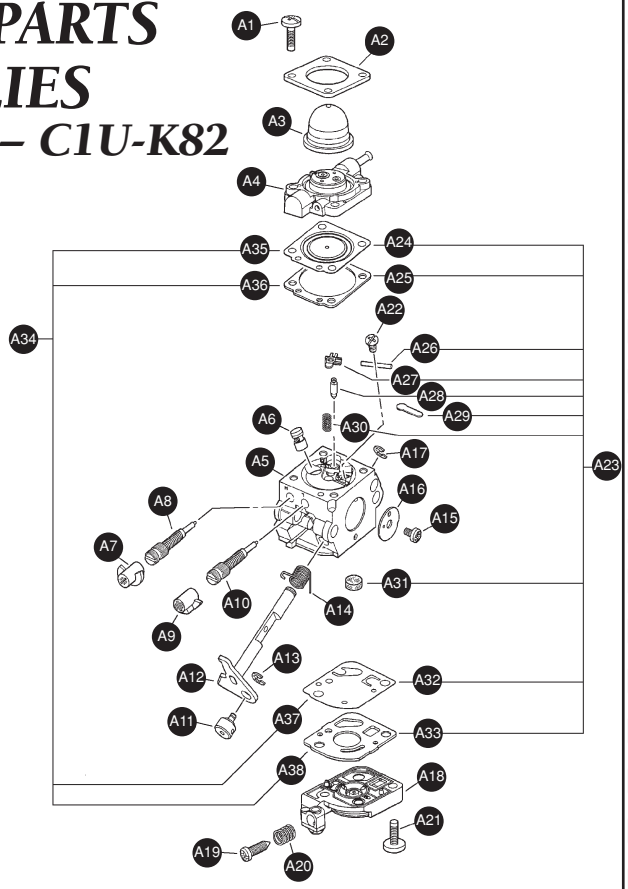


When you look at Tine with the raised hub facing you and the teeth are pointing in a ***COUNTER CLOCKWISE*** rotation, you and a ***RIGHT HAND TINE***.

SV-5CI/2 ENGINE PARTS ASSEMBLIES

CARBURETOR – C1U-K82

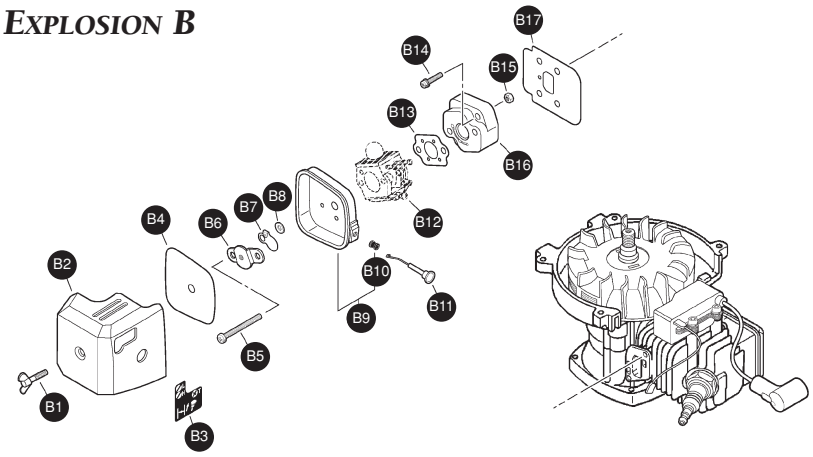
EXPLOSION A



ITEM	PART #	QTY.	DESCRIPTION / REMARKS
A1	P005000980	4	SCREW, PURGE BASE
A2	P005000620	1	RETAINER, PURGE BULB
A3	12538108660	1	BULB, PURGE
A4	P005000970	1	BASE, PURGE
A5	----------	1	BODY, CARBURETOR / NOT AVAILABLE SEPARATELY
A6	12537613120	1	NOZZLE, CHECK VALVE
A7	12532939030	1	CAP, LIMITER - HIGH SPEED -- RED
A8	12532013310	1	NEEDLE - HIGH SPEED
A9	12532909860	1	CAP, LIMITER - LOW SPEED -- WHITE
A10	12531813120	1	NEEDLE - LOW SPEED
A11	12537242030	1	SWIVEL
A12	P005001070	1	SHAFT, THROTTLE
A13	12532713930	1	CLIP, SWIVEL
A14	12531342030	1	SPRING, THROTTLE RETURN
A15	12531413930	1	SCREW, THROTTLE VALVE
A16	12531649030	1	VALVE, THROTTLE
A17	12532715130	1	CLIP, THROTTLE SHAFT
A18	12532412820	1	COVER, FUEL PUMP
A19	12533406960	1	SCREW, IDLE ADJUST
A20	12533306960	1	SPRING, IDLE ADJUST
A21	12531012820	2	SCREW, FUEL PUMP COVER
A22	12533942030	1	SCREW, METERING LEVER PIN
A23	12530013120	1	REPAIR KIT / INCLUDES ITEMS 24-33
A24	----------	1	DIAPHRAGM, METERING
A25	----------	1	GASKET, METERING DIAPHRAGM
A26	----------	1	PIN, METERING LEVER
A27	----------	1	LEVER, METERING
A28	----------	1	VALVE, INLET NEEDLE
A29	----------	1	WELCH PLUG
A30	----------	1	SPRING, METERING LEVER
A31	----------	1	STRAINER
A32	----------	1	DIAPHRAGM, FUEL PUMP
A33	----------	1	GASKET, FUEL PUMP
A34	12530313120	1	GASKET/DIAPHRAGM KIT / INCLUDES ITEMS 35-38
A35	----------	1	DIAPHRAGM, METERING
A36	----------	1	GASKET, METERING DIAPHRAGM
A37	----------	1	DIAPHRAGM, FUEL PUMP
A38	----------	1	GASKET, FUEL PUMP

AIR CLEANER

EXPLOSION B

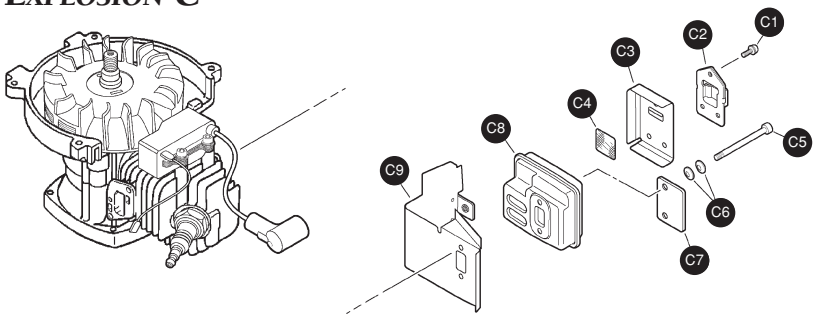


ITEM	PART #	QTY.	DESCRIPTION / REMARKS
B1	90052800005	1	WING BOLT
B2	13032611522	1	COVER, AIR CLEANER
B3	89012147530	1	LABEL, CHOKE
B4	13031004560	1	FILTER, AIR
B5	90024205057	2	SCREW 5X57
B6	13041005360	1	PLATE, PREVENT
B7	17851504560	1	SHUTTER, CHOKE
B8	17851600830	1	SPACER
B9	13030104560	1	CASE, AIR CLEANER / INCLUDES ITEM 10
B10	17881005230	1	GROMMET
B11	17851004560	1	ROD, CHOKE
B12	----------	1	CARBURETOR
B13	13001642031	1	GASKET, INTAKE[1]
B14	90023805020	2	SCREW 5X20 / SEE CARBURETOR DIAGRAM FOR ADDITIONAL INFORMATION
B15	90050000005	2	NUT 5
B16	13001742031	1	INSULATOR
B17	V103000490	1	SHIELD, INTAKE[1]

[1] ALSO INCLUDED IN GASKET KIT (PAGE 19)

MUFFLER

EXPLOSION C



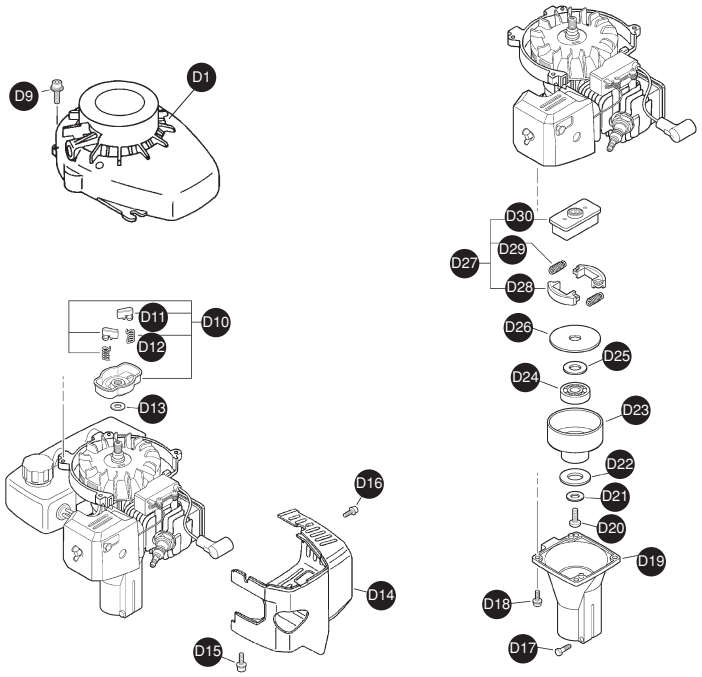
ITEM	PART #	QTY.	DESCRIPTION / REMARKS
C1	9136704012	3	SCREW 4X12
C2	A313000700	1	GUIDE, EXHAUST
C3	V104000072	1	GASKET, EXHAUST[1]
C4	14586240630	1	SCREEN, MUFFLER
C5	90010505055	2	SCREW 5X55
C6	V347000000	4	WASHER, CONICAL
C7	V150000371	1	EYE PLATE
C8	A300000521	1	MUFFLER
C9	V104000590	1	SHIELD, EXHAUST[1]

[1] ALSO INCLUDED IN GASKET KIT (PAGE 19)

SV-5CI/2 ENGINE PARTS

ENGINE COVER, FANCASE, STARTER, CLUTCH CASE & CLUTCH

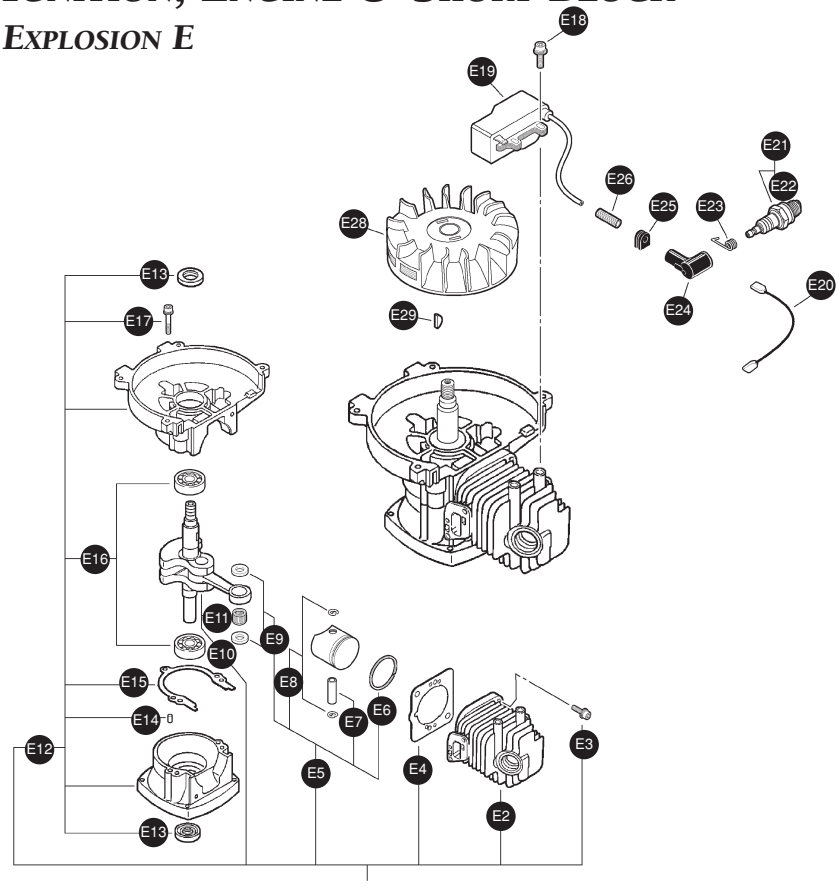
EXPLOSION D



ITEM	PART #	QTY.	DESCRIPTION / REMARKS
D1	811025	1	STARTER ASY / INCLUDES ITEMS 2-8
D9	90023804016	4	SCREW 4X16
D10	17720212220	1	STARTER PAWL ASY / INCLUDES ITEMS 11-12
D11	17721844330	2	PAWL, STARTER
D12	17723412220	2	SPRING, RETURN
D13	90060500008	1	SPRING WASHER 8
D14	A160000610	1	COVER, ENGINE
D15	90023804018	2	SCREW 4X18
D16	9110704008	1	SCREW 4X8
D17	13041611520	1	BOLT 5X25
D18	90023804018	4	SCREW 4X18
D19	61022311520	1	CASE, CLUTCH
D20	90023806012	1	SCREW 6X12
D21	17501411520	1	WASHER, CLUTCH
D22	17504404630	1	WASHER, CLUTCH
D23	17501004635	1	DRUM, CLUTCH
D24	90080836000	1	BEARING, BALL
D25	90060000010	1	WASHER 10
D26	17501904630	1	PLATE, CLUTCH
D27	17500007531	1	CLUTCH/ASY / INCLUDES ITEMS 12-14
D28	17500905131	2	SHOE, CLUTCH
D29	17501805130	2	SPRING, CLUTCH
D30	17501605020	1	HUB, CLUTCH

IGNITION, ENGINE & SHORT BLOCK

EXPLOSION E



ITEM	PART #	QTY.	DESCRIPTION / REMARKS
E2	A130000550	1	CYLINDER
E3	90016205022	2	SCREW 5X22
E4	V100000160	1	GASKET, CYLINDER[1]
E5	P021007712	1	PISTON KIT / INCLUDES ITEMS 6-9
E6	A101000090	1	RING, PISTON
E7	10001311520	1	PIN, PISTON
E8	10001504630	2	CIRCLIP, PISTON PIN
E9	10001411520	2	SPACER, PISTON PIN
E10	A011000390	1	CRANKSHAFT ASY / INCLUDES ITEM 11
E11	V553000060	1	BEARING, NEEDLE
E12	10020411521	1	CRANKCASE KIT / INCLUDES ITEMS 13-17
E13	10021242031	2	OIL SEAL
E14	V622000020	2	DOWEL PIN - 4X7.8MM
E15	10024242030	1	GASKET, CRANKCASE[1]
E16	9403536201	2	BEARING, BALL - 6201
E17	90016205028	3	SCREW 5X28
E18	9111304020	2	SCREW 4X20
E19	A411000220	1	COIL, IGNITION
E20	16202152830	1	LEAD, IGNITION
E21	15901019830	1	SPARK PLUG -- BPM-8Y
E22	A425000000	1	SPARK PLUG -- BPMR-8Y[2]
E23	15901103432	1	TERMINAL, SPARK PLUG
E24	15901201620	1	CAP, SPARK PLUG
E25	15611004920	1	BUSHING
E26	V475002200	1	TUBE, INSULATOR
E27	A409000150	1	FLYWHEEL
E28	61032502730	1	WOODRUFF KEY

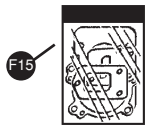
[1] ALSO INCLUDED IN GASKET KIT (PAGE 19)
[2] CANADA MODELS

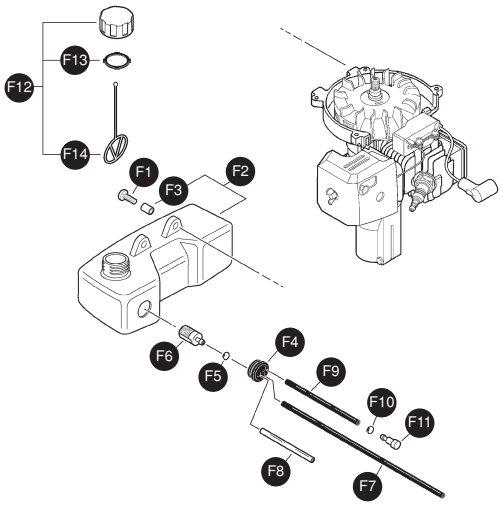
SV-5CI/2 ENGINE PARTS

FUEL SYSTEM

EXPLOSION F

GASKET KIT





ITEM	PART #	QTY.	DESCRIPTION / REMARKS
F1	90027505015	3	SCREW 5X15
F2	A350000300	1	TANK, FUEL / INCLUDES ITEM 3
F3	13104528230	3	SPACER
F4	V137000030	1	GROMMET
F5	13201309820	1	CLIP
F6	13120507320	1	FILTER, FUEL
F7	V471001230	1	PIPE, FUEL - 3X5X210MM / BULK OPTION: 90014
F8	13201049030	1	PIPE, RETURN - 3X6X50MM / BULK OPTION: 90017
F9	V471001200	1	PIPE, VENT - 3X5X70MM / BULK OPTION: 90014
F10	13011100530	1	CLIP, PIPE
F11	A356000030	1	VENT ASY
F12	13100409060	1	CAP ASY / INCLUDES ITEM 13-14
F13	13101655830	1	GASKET, CAP
F14	13105156030	1	CONNECTOR, CAP
F15	P021009110	1	GASKET KIT

ECHO INCORPORATED EMISSION CONTROL WARRANTY STATEMENT

FOR ECHO AND SHINDAIWA BRANDS

The Environmental Protection Agency (EPA) and the California Air Resources Board (C.A.R.B.) and ECHO Incorporated (ECHO Inc.) are pleased to explain the emission control system warranty on your 2010 and later equipment/small off-road engine (SORE). New equipment/SORE must be designed, built and equipped to meet stringent EPA and C.A.R.B. anti-smog standards. ECHO Inc. must warrant the emission control system on your equipment/SORE for the periods of time listed below, provided there has been no abuse, neglect or improper maintenance of your equipment/SORE. Your emission control system may include parts such as: carburetor, fuel-injection system, ignition system, catalytic converter/muffler, fuel tank, fuel feed lines, fuel cap assembly, spark plug, air filters, and other associated components. Where a warrantable condition exists, ECHO Inc will repair your equipment/SORE at no cost to you including diagnosis, parts and labor. The Emission Control System warranty is extended to the original owner including all subsequent owners.

MANUFACTURER'S WARRANTY COVERAGE:

The emission control system is warranted for 2 years or the length of the ECHO Inc. warranty, whichever is longer. If any emission-related part on your equipment is defective, the part will be repaired or replaced by ECHO Inc. or its Authorized Service Representative.

OWNER'S WARRANTY RESPONSIBILITIES:

As the equipment/SORE owner, you are responsible for the performance of the required maintenance listed in your Operator's Manual. ECHO Inc. recommends that you retain all receipts covering maintenance on your equipment/SORE however, ECHO Inc. cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance. As the equipment/SORE owner, you should be aware that ECHO Inc. may deny you warranty coverage if your equipment/SORE or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

You are responsible for presenting your equipment/SORE to an ECHO Inc. authorized service representative as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days. If a warrantable condition exists and there is no Authorized Dealer within 100 miles, ECHO Inc. will pay to ship the unit to the nearest authorized dealer. If you have questions regarding your warranty coverage, you should contact ECHO Inc. at 1-800-673-1558, web site WWW.ECHO-USA.COM or contact Shindaiwa at 1-877-986-7783, web site WWW.SHINDAIWA.COM.

WHAT DOES THIS WARRANTY COVER?

ECHO Inc. warrants that your equipment/SORE was designed, built and equipped to conform with applicable EPA and C.A.R.B. emissions standards and that your equipment/SORE is free from defects in material and workmanship that would cause it to fail to conform with applicable requirements for 2 years or the length of the ECHO Inc. warranty, whichever is longer. The warranty period begins on the date the product is purchased by an end user..

HOW WILL A COVERED PART BE CORRECTED?

If there is a defect in a part covered by this warranty, any ECHO Inc. Authorized Service Dealer will correct the defect. You will not have to pay anything to have the part adjusted, repaired or replaced. This includes any labor and diagnosis for warranted repairs performed by the dealer. In addition, engine parts not expressly covered under this warranty but whose failure is a result of a failure of a covered part will be warranted.

WHAT PARTS ARE COVERED?

- Any applicable emission related part not scheduled for "required maintenance" will be repaired or replaced within the warranty period. The repaired or replaced part will be warranted for the remaining ECHO Inc. warranty period.

Continued

- Any warranted part that is scheduled only for regular inspection in the written instructions supplied is warranted for the warranty period stated above. Any such part repaired or replaced under warranty will be warranted for the remaining ECHO Inc. warranty period.
- Any emission related part scheduled for replacement during "required maintenance" is warranted for the period of time prior to the first scheduled replacement point for that part. Any such part repaired or replaced under warranty shall be warranted for the remainder of the period prior to the first scheduled replacement point for that part.
- Any manufacturer-approved replacement part may be used in the performance of any warranty maintenance or repairs on emission related parts, and must be provided without charge if the part is still under warranty.
- Any replacement part that is equivalent in performance and durability may be used in non-warranty maintenance or repairs, and shall not reduce the warranty obligations of the manufacturer.
- Throughout the equipment/SORE warranty period, ECHO Inc. will maintain a supply of warranted parts sufficient to meet the expected demand for such parts.

SPECIFIC EMISSION RELATED WARRANTED PARTS:

- Electronic Ignition System
- Catalytic Converter / Muffler Assembly
- Choke
- Fuel Tank
- Air Filter
- Spark Plug
- Carburetor (complete assembly or replaceable components)
- Fuel-Injection Assembly (or replaceable components)
- Fuel Cap Assembly
- Fuel Feed Line (and associated clamps/connectors as applicable)

WHAT IS NOT COVERED?

Any failure caused by abuse, neglect, improper maintenance, unapproved modifications, use of unapproved add-on parts/modified parts or unapproved accessories.

This Emission Control Warranty is valid only for the U.S.A., it's Territories, and Canada. 99922201033 01/2010

MANTIS TILLER LIMITED WARRANTY

MANTIS extends this limited warranty against defects in material and workmanship for a period of five (5) years for normal residential purposes and two (2) years for commercial use from the date of purchase, to the first retail purchaser and each subsequent owner, during the warranty period. This warranty covers all portions of the MANTIS TILLER.

MANTIS will repair or replace, at its option, any part or parts of the product proven to be defective in material or workmanship under normal usage during the warranty period. Warranty repairs and replacements will be made without charge for parts or labor. All parts replaced under warranty will be considered as part of the original product, and any warranty on the replaced parts will expire coincident with the original product warranty. If you think your MANTIS TILLER is defective in material or workmanship, you must send it, along with your proof of purchase (sales receipt) to:

Mantis
1028 Street Road
Southampton, PA 18966

You are responsible for pickup and delivery charges; the product must be returned to us postage paid.

MANTIS assumes no responsibility in the event that the product was not assembled or used in compliance with any assembly, care, safety, or operating instructions contained in the Owner's Manual or accompanying the product; was not used with reasonable care or requires replacement or repair due to accidents or lack of proper maintenance; or was misused, altered, used for other than normal or intended purposes. This warranty does not cover damage due to normal wear and tear.

You must maintain your MANTIS TILLER by following the maintenance procedures described in the owner's manual. Such routine maintenance, whether performed by you or a dealer, is at your expense.

MANTIS MAKES NO EXPRESS OR IMPLIED WARRANTIES OR REPRESENTATIONS EXCEPT THOSE CONTAINED HEREIN. THE DURATION OF ANY IMPLIED WARRANTY, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IS LIMITED TO THE DURATION OF THIS WRITTEN LIMITED WARRANTY. MANTIS DISCLAIMS ALL LIABILITY FOR INDIRECT, INCIDENTAL AND/OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE USE OF THE MANTIS PRODUCTS COVERED BY THIS WARRANTY. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS AND/OR DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THAT ABOVE LIMITATIONS AND EXCLUSIONS MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATES TO STATE.

MANTIS
1028 Street Road
Southampton, PA 18966
(215) 355-9700

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